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EDITORIAL

IT might have been expected that after some months of official war we would be able to furnish our readers with interesting and valuable accounts of the experiences of anæsthetists at their work in war conditions. Unfortunately—or we should say fortunately—hitherto war conditions have not imposed on the many anæsthetists who are serving the State in one department or another any difficulties of practice different from those which they encounter in their ordinary peace-time work. It is true, of course, that most of our British readers are no longer conducting their ordinary practices. But the practice on which they are engaged, in military or Ministry of Health hospitals, does not, up to date, differ from what they were accustomed to do in peace-time in the civilian hospitals to which they were attached. Indeed, the only difference for many of us is that the work is so much less, because we are added to the already sufficient staff of hospitals which are prepared for a rush of air-raid casualties which up to the present have been entirely absent. It may be that by the time these words are in print the situation will have changed. It may be that the future will bring large-scale fighting to France or extensive bombing raids over Great Britain. If that should be so we have no doubt that in a future number we shall be able to furnish our readers with accounts of the experiences of anæsthetists in real war conditions. So far, much has been written about war-time anæsthetics. It is, however, all speculative and advisory, and we see no reason to add further contributions of this character.

ENDOTRACHEAL ANÆSTHESIA IN INFANTS

BY

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WHEREAS the medical profession is only beginning to realise that anæsthesia in young children is not easy but difficult, it has long since appreciated the fact that tracheal intubation is a difficult manœuvre in these subjects. For all operations on the head or neck endotracheal anæsthesia, however, offers certain safeguards to the patient, and great advantages both to the surgeon and the anæsthetist. Magill[1, 2] has put forward the advantages and safeguards of the method, and these are now so universally accepted as to require no further comment. For plastic surgery of the face, palate, lip, or eye, the method is almost essential.

In very young children, however, the intubation itself is more difficult than in adults, and in inexperienced hands may endanger the patient. Only repeated practice can teach that gentleness of handling which is essential if complications are to be avoided. Since cases in which the method is desirable are rare, less efficient methods tend to be employed.

This paper is based upon an experience of one hundred and ninety-seven intubations in children, with special reference to seventy cases under the age of eighteen months. Its purpose is to advocate the use of endotracheal anæsthesia in infants, to the end that the surgeon's work may be facilitated, and that the patient may be free from the immediate or remote dangers resulting from respiratory obstruction.

The majority of these patients were anæsthetised for the plastic department of Mr. T. P. Kilner at the Princess Elizabeth of York Hospital for Children, Shadwell; and this paper gives an account of the technique which has proved satisfactory.

Pre-operative Measures.

Pre-operative medication destined to abolish mucus secretion is eminently desirable. Infants tolerate atropine well, and 1/300th of a grain is usually an appropriate dose, even at six weeks of age. Above this age the morphine-hyoscine dosage suggested by Leech[3] is excellent.

It is wise to ensure, by bacteriological examination, the absence of the Klebs-Loeffler bacillus and the hæmolytic streptococcus from the throat, for, apart from surgical considerations, it is in the presence of these organisms that trauma during laryngoscopy may result in post-operative œdema of the glottis.

Induction of Anæsthesia.

I am satisfied that smoothness of induction to the appropriate plane of anæsthesia is the factor most conducive to easy intubation. The induction is begun with nitrous oxide to which oxygen is added before any cyanosis develops; and ether is added progressively to the mixture of gases. Any of the common makes of apparatus should be satisfactory: my own experience is limited to the Boyle and Foregger machines.

Induction should be slow and progressive, every effort being made to avoid glottic spasm. When the respiration is regular and automatic, the mandible is fully relaxed, and any trace of spasm of the glottis has been abolished, intubation may be undertaken. These conditions are usually present in the second plane of third stage anæsthesia. I believe it is justifiable to add 5 per cent of pure carbon-dioxide to the gas mixture for a minute immediately prior to intubation in order to produce a hyperpnœa.

Such an induction may be easy, and intubation may be practicable within six minutes, but if the child is prone to exhibit glottic spasm, patience alone will enable induction and intubation to be smooth, even if the process occupies twenty minutes. Those few surgeons who realise the truth of this have found their initial patience well rewarded, both in the matter of smooth anæsthesia and of absence of post-operative complications.

Laryngoscopy.

Mr. Kilner's technique[4] necessitates oral intubation both for lip and palate cases. The exposure of the larynx presents certain

difficulties in the young infant: the epiglottis is proportionately longer than in the adult, there is very little space between the epiglottis and the glottis, and with each breath the larynx tends to move anteriorly out of the field of vision. Flagg[5] and Gibberd and Blaikley,[6] writing on intubation for the treatment of asphyxia neonatorum, have pointed out that in these cases the complete flaccidity of the child makes it possible to expose the larynx simply by elevating the base of the tongue. While this has also been my experience in cases of asphyxia neonatorum, I have been unable to use this technique successfully in lip or palate cases. The young infant will usually not tolerate the deep anæsthesia of the third or fourth planes of the third stage without signs of impending circulatory or respiratory failure, and it is only at these depths that the relaxation is comparable to that seen in cases of asphyxia.

Extreme gentleness of manipulation is essential during laryngoscopy and intubation. All the structures in the infant's pharynx are small, delicate, and easily damaged. The use of any force will result in complications varying in severity from a slight " croupy " cough to an acute œdema of the glottis.

Magill's laryngoscope, although excellent for use in adults, is not a convenient instrument for infants of less than eighteen months in age. Its shape makes it almost impossible to use, the blade is both too large and too thick, and the lamp-carrier, by projecting into the lumen of the speculum, both obstructs the view and impedes the passage of the tube. To overcome these difficulties, Messrs. Mayer and Phelps have kindly made for me a modification of the smallest size of Chevalier Jackson's laryngoscope, which is retailed by A. Charles King Ltd. under the name of a " Shadwell " laryngoscope. (Fig. 1).

This small instrument has proved satisfactory for these infants under two years of age. The handle is set at right angles to the blade, and is of a size rather to be held between the fingers than in the palm of the hand. This helps to discourage the use of force. The type of electric bulb with which this instrument is fitted is notoriously fragile, and therefore a recess has been built into the handle of the instrument which will accommodate two spare bulbs. The lamp-carrier lies in a channel outside the lumen of the speculum, and the bulb is sunk so that it does not project into the lumen. The lamp-carrier and

FIG. 1. *Shadwell Laryngoscope.*

FIG. 2. *Magill attachment.*

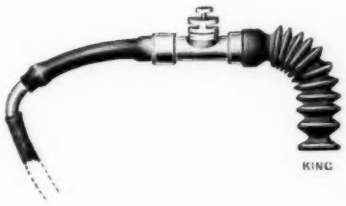

FIG. 3.
Terminal end of Magill attachment, face mask and angle mount detached.

the speculum can both be removed so that the latter can be sterilized by boiling. The speculum is provided with a removable slide. The instrument is passed with the slide in place so that if the patient has a projecting premaxilla or upper incisor tooth this cannot project into the lumen of the instrument and obstruct the view. When the larynx has been exposed the slide is removed, and the tube is passed down the open slot.

Intubation.

There is considerable variation in size of the glottis in infants. The following table gives the sizes of Magill tubes which I have usually found appropriate at the ages stated:

Age	Magill Tube Size	External Diameter
Less than 3 months	00	4 mm.
3 to 9 months	0A	5 mm.
9 to 15 months	0	6 mm.
15 to 21 months	1	7 mm.

It is important to avoid narrowing an already small airway, and the largest possible tube should be passed. It is usually wise to prepare one of each of these sizes, and to try the largest gently, passing a smaller size if necessary.

Too long a tube, especially when pressed downwards by the opening of a Dott's gag[4], will naturally enter a main bronchus: usually the right. As the tubes are commonly cut left-handed, the bevel comes to rest against the medial wall of the bronchus, and complete respiratory obstruction results, as Ayre[10] points out. This state of affairs both can result and has resulted in the death of the patient from oxygen want. A length of twelve centimetres is sufficient for a " 00 " size tube: if any doubt exists on this point the tube can be roughly measured beforehand by laying it alongside the child's neck. It should not exceed in length the distance from the lower incisor teeth to a point midway between the thyroid cartilage and the angle of Louis (i.e. the level of the second costal cartilage).

Nasal intubation is rarely necessary in infants. The " blind " technique of nasal intubation is very much more difficult in an infant than in an adult. There are certain anatomical reasons for this:

(1). "Passavant's ridge", the structure formed by the upper fibres of the superior constrictor muscle, is more prominent in infants, and it tends to deflect the tube from the midline during its passage through the nose.

(2). There is usually considerable hyperplasia of the adenoid tissue, and this has a similar effect.

(3). The length of the epiglottis is such that it tends to cover the glottic opening.

One size larger tube can almost always be used through the mouth, and this is a sound argument for avoiding the nasal route wherever possible in infants. In this series of cases "blind" intubation was attempted in seven cases and failed in every case. I believe that it is worth while to attempt blind intubation once, when the child is sufficiently relaxed for laryngoscopy. But if the attempt does not immediately succeed laryngoscopy should be performed and the tube inserted under direct vision.

Geoffrey Kaye[7], in an article on another subject, says: "Infants were found to resent endotracheal intubation, and to suffer from an intense respiratory spasm as soon as it was performed. This spasm caused much anoxæmia, and even when oxygen had been given, was apt to leave the circulation depressed." This has also been my experience when intubation has been performed at somewhat too light a plane of anæsthesia. Slightly deeper anæsthesia abolishes the phenomenon. The anæsthetist should be aware of this possibility and be prepared gently to inflate the lungs manually with pure oxygen from the breathing-bag should it occur.

Maintenance.

The tube is connected by the usual rubber connection—which should be short to minimise dead space—to the end of a "Magill attachment" (Fig. 2), consisting of expiratory valve, corrugated rubber hose, and breathing bag.

Three physiological necessities should be constantly borne in mind during both induction and maintenance:

First: An oxygen supply of not less than the normal twenty per cent in the inspired gas mixture. I prefer to exceed this quantity rather than to run any risk of oxygen want.

Second: The adequate removal of the expired carbon dioxide.

To this end the expiratory valve is set so that it blows off at minimal pressure, and a rate of gas flow of not less than five litres per minute is maintained.

Third: The absence of any resistance to respiration. This is largely a matter of making sure that the expiratory valve remains loose and thus that the child does not have to expire against a positive gas pressure. Lying centrally beneath the towels as the valve does, the movements of the assistant can sometimes alter its setting. A constant watch should be kept for this occurrence.

In palate cases the opening of the Dott gag can compress the tube and obstruct it against the root of the tongue. It is wise to use a firm tube for these patients. If this is done and the surgeon watches the result of opening the gag, and alters the position of gag and tube slightly, the kinking of the tube can usually be avoided. A long metal connection should be inserted for at least half an inch into the tube so that it lies between the gag and the lower incisor teeth.

In order to obtain smooth anæsthesia some ether must usually be added to the gas mixture throughout. In practice this amounts to the minimal blow-over from one small bottle of a Boyle's apparatus. In sixty-four of my cases the average duration of anæsthesia was sixty-three minutes, and the total consumption of ether averaged 2.2 fluid ounces per case.

Ayre[8 10], in two recent articles, disagrees with this method, and paints an unpleasant picture of the infant during and after operation. Apparently at one time he attempted to maintain anæsthesia with nitrous oxide-oxygen, but without ether, for he suggests that his poor results were the outcome of "anoxæmia and excessive rebreathing". I emphatically agree with this view, but feel nevertheless that with the above technique the Magill bag and valve can be used without producing either anoxæmia or deficient elimination of carbon dioxide. Since our experience has been free from the troubles described by Ayre, I believe that under the conditions I have described no undue strain is thrown on the child's respiratory system.

Ayre now uses ether-oxygen mixtures without the use of a breathing bag. Twenty-two years ago Boyle[9] said: "I believe that gas and oxygen with a little ether when necessary provide us with a better anæsthesia and a more favourable after-state

than can be obtained by any other method ". This has also been my experience, and I believe it to be as true of infants as of adults.

Observation of the Patient.

The usual criteria in the adult are of little help in the infant to the anæsthetist striving to form an opinion of the patient's condition. The pulse-rate is always rapid, and in infants under three months of age so rapid as to make accurate counting impossible. These children are too small to permit of estimations of the blood-pressure. The pulse rate has varied little during operation, and volume changes have been difficult to appreciate in the small radial artery of the infant. Probably the best plan is to strap a phonendoscope over the child's præcordium so that changes in intensity of the heart sounds can be noted. I have only been able to do this in a few isolated cases, but these gave me the impression that the result of surgical trauma or hæmorrhage is to diminish the intensity of the heart sounds. Probably the surgeon, who can see the state of the circulation from the character of the bleeding in the wound, is best able to judge of the condition of the patient. If losses of blood or fluid are excessive these should be treated on the same principles as in adults.

Mortality.

Six children have died in this series of seventy cases. The essential details are as follows:—

(1). A healthy male child, ten weeks old, and weighing nine pounds fifteen ounces, was operated upon for the primary closure of a cleft lip. Anæsthesia, operation and recovery were uneventful until the fourteenth day. The child then developed diphtheria, of which there was an infection prevailing in the ward at that time. It was removed to a fever hospital, where it died of diphtheria on the seventeenth day after operation.

(2). A healthy female infant, seven weeks old, weighing eighteen pounds five ounces, was operated upon for the removal of a parasitic fœtus in the lumbar region. After the removal of the parasite a meningocœle was found beneath it. At the end of the operation the child's condition was fair, and improved during that day. On the night after operation, however, cere-

brospinal fluid began to leak from the suture line and the child's temperature rose abruptly to 104° F. The next morning moist sounds were heard over the left base and tubular breathing in the left axilla, and the child's respiratory rate rose to fifty-six. It died thirty-six hours after the operation. No autopsy was held, but it was thought that the leakage of cerebrospinal fluid was responsible for a " fourth ventricle pressure cone " phenomenon.

(3). A bronchitic female baby, four weeks of age, and weighing eight pounds six ounces, was operated upon for the primary repair of a cleft lip. Anæsthesia, operation, and recovery were uneventful. On the eleventh day the child developed a catarrhal gastro-enteritis to which it succumbed in three weeks. A post-mortem examination confirmed this fact.

(4). A healthy male child, fourteen months old and weighing twenty pounds, was operated upon for an extensive secondary closure of a cleft lip. It was a lengthy operation involving considerable loss of blood, and the child showed signs of this during the operation. It recovered considerably, however, during the suturing, regained consciousness by the end of the operation, and was crying normally when removed to the ward—even though its pulse was thready and its skin pallid. Half an hour later, when I had left the hospital, the ward reported that the child appeared to be suffering from respiratory obstruction. It was brought back to the theatre suffering from gross oxygen want. The surgeon performed a laryngoscopy and re-inserted a Magill tube, through which oxygen was gently forced by manual pressure from the breathing bag of the Boyle's apparatus. The child, however, never recovered; its circulation failing some forty-five minutes after the oxygen administration was begun. The surgeon, when he exposed the larynx, had seen what he took to be either a small blood-clot or plug of mucus lying in the upper end of the trachea. At autopsy, a small area of collapse was found in one lung, and the myocardium was white and flabby.

I feel that my judgment was at fault in this case. The child died of relative oxygen want when in a state of surgical shock. Had I assessed the degree of shock correctly and suggested that it be treated in time the child would probably have recovered sufficiently to cough out the foreign body and relieve its own respiratory obstruction.

(5). A male child, fourteen weeks old, in good health and weighing twelve pounds was operated upon for the primary closure of a hare lip. Anæsthesia, operation, and convalescence were uneventful until the ninth day, when the child developed a catarrhal gastro-enteritis of which it died during the third week after operation.

(6). A healthy male child, eleven weeks old and weighing ten pounds, was operated upon in order to close a primary cleft lip. Again the operation, anæsthesia and recovery were uneventful, but the child developed gastro-enteritis on the seventeenth day after operation. It succumbed to this condition during the third week, having developed a terminal purulent pericarditis.

Complications.

Certain complications have already been mentioned in considering the cases which died. Apart from these the following complications occurred in this series of seventy cases under eighteen months of age:

	Cases
Nausea and vomiting:	
During the first 12 hours only	20
Persisting for more than 12 hours	1
Nil	49
Catarrhal gastro-enteritis	3
Exacerbation of pre-existing bronchitis	2
Cough wthout physical signs	5
Slight laryngitis	2
Post-operative respiratory obstruction	2
Otitis media	3
Pyrexia over 100° F.	32
Pyrexia over 103° F.	4
Post-operative restlessness	3
Conjunctivitis	1
Chicken-pox	1

It has been our custom always to leave a stout silkworm-gut suture in the tongue at the end of the operation, as a precaution against respiratory obstruction during the period of recovery. In spite of this precaution obstruction occurred in two of these cases.

None of the three cases of otitis media occurred in patients who had been intubated by the nasal route.

The surgeon sits at the head of the table to operate, and works from behind the patient. It has been our custom to instil a drop of sterile liquid paraffin into each eye before the towels are put into place. In spite of this precaution one patient in this series developed a conjunctivitis of moderate severity in one eye as a result of the friction of the sterile towel upon the exposed cornea. This subsided within forty-eight hours.

It is outside my province here to discuss the very interesting postoperative pyrexia commonly seen in infants and its significance. The fact remains that the majority of these cases exhibit some pyrexia after operation, and that corresponding rises in the pulse and respiratory rates occur.

Conclusion.

The experience of these cases has convinced me that endotracheal anæsthesia is a safe and satisfactory proceeding in infants; and that any additional risk inherent in the intubation is more than compensated for by the subsequent absolute control of the airway by the anæsthetist. Smooth and safe anæsthesia can by this method be maintained for almost unlimited periods of time, the anæsthetist and his paraphernalia are remote from the site of operation, and the surgeon can work unhampered by worries arising from the necessity of maintaining an unobstructed airway.

Furthermore, as long as the dangers inherent in oxygen want or carbon dioxide excess are recognised and prevented, this technique of anæsthesia does not appear to provoke any gross disturbance of respiratory physiology in the infant. If the closed carbon dioxide absorption technique can be conveniently applied to these patients, it may be that in days to come we may more nearly approach normal respiration in the infant during anæsthesia, and that it will be possible to use cyclopropane for these operations.

Finally, I wish to express my deep gratitude and sincere thanks to Mr. T. P. Kilner for his never-failing co-operation, kindness, and help; and to Dr. R. M. Waters for his helpful criticism of this paper.

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AUTO-INHALATIONAL CARBON-DIOXIDE THERAPY

BY

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THE successful issue in carbon dioxide inhalational therapy depends upon the administration of a percentage specific for the individual patient.

An increase of carbon dioxide in the blood stimulates the respiratory centre, provided the threshold is normal. If the state of irritability of the centre is diminished, the stimulus may evoke no response. Thus, an increase of three per cent. carbon dioxide in the inspired air doubles the pulmonary ventilation in the normal patient, or produces little or no result where the threshold is decreased by opiates or other depressant drugs.

Effective therapy, therefore, demands that the threshold shall be first determined by a process of trial and error and an adequate strength of carbon dioxide inhaled.

Certain machines, such as the Carbetha type, are calibrated so that any desired proportion, from three to seven per cent. of the gas in air may be given, or it may be obtained pure in sparklets. If values over 10 per cent. are available they should only be used by an anæsthetist, although this is not often practical in the post-operative period.

Cylinders of carbon dioxide and oxygen (95 per cent.) mixture are available, but the apparatus necessary for inhalation is cumbersome.

These methods have the following disadvantages:

1. Cylinders are apt to run out at inconvenient times;
2. The maintenance costs are fairly high;
3. Over-dosage is not impossible;
4. Effective therapy requires the determination of the respiratory threshold in each case;
5. Fixed percentages may sometimes be ineffective.

Now if the carbon dioxide in the patient's expirations could be utilised to stimulate his own respiratory centre in the way to be described, no cylinders are required and it will be seen that the method is specific, effective, and free from the risk of overdose.

In the early days of carbon dioxide therapy this principle was used, and it was not uncommon to see patients with their heads enclosed in large paper bags—a somewhat inaccurate method.

The following is a description of an apparatus depending for its action on the principle of re-breathing, which automatically delivers the specific strength of carbon dioxide for the individual.

It consists of a face mask which is separately connected by means of a rubber T-piece to a length of tubing on the one side and to a rubber bag of fine consistency on the other. (See Fig. 1). The tube is open to the air at its distal end. There are no valves, and there is no resistance to the free passage of air. (See also photographs).

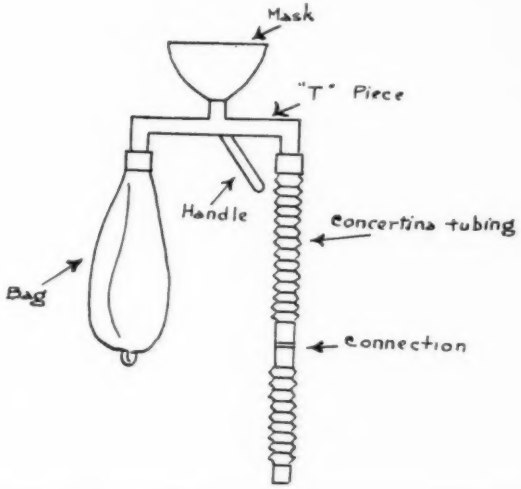
When used the result is that the patient's dead space is increased and a certain amount of expired air containing 4.1 per cent. carbon dioxide is inhaled. The percentage of carbon dioxide is regulated in the following way.

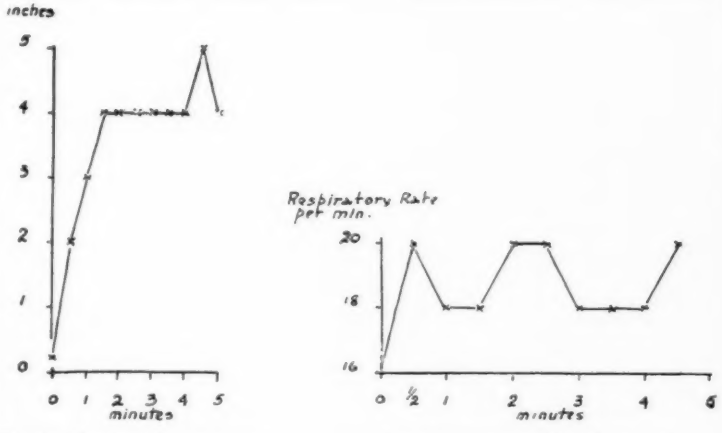
As it rises from the accumulation of expired air in the apparatus, the breathing becomes deeper and the percentage falls on account of dilution with atmospheric air. This decreases the pulmonary ventilation and the carbon dioxide rises again. The cycle is then repeated.

In order to make the principle mathematically clear, let us take, for example, a patient having a tidal volume of 500 c.c. He uses a side tube having a volume of 200 c.c., assuming that roughly half each respiration passes into the tube and bag respectively. He breathes into the apparatus, filling it with expired air, and when an inspiration takes place it will have the following composition: 200 c.c. expired air from the bag (4.1 per cent. CO_2), 8.1 c.c. CO_2; 200 c.c. expired air from the tube, 8.1 c.c. CO_2; 100 c.c. atmospheric air (0.04 per cent. CO_2), 0.1 c.c. CO_2. Total 500 c.c. containing 16.24 c.c. CO_2, i.e. 3.2 CO_2.

The inhalation of three per cent. carbon dioxide practically doubles the pulmonary ventilation. The tidal volume, therefore, increases to 1,000 c.c. Thus more air is inhaled and the

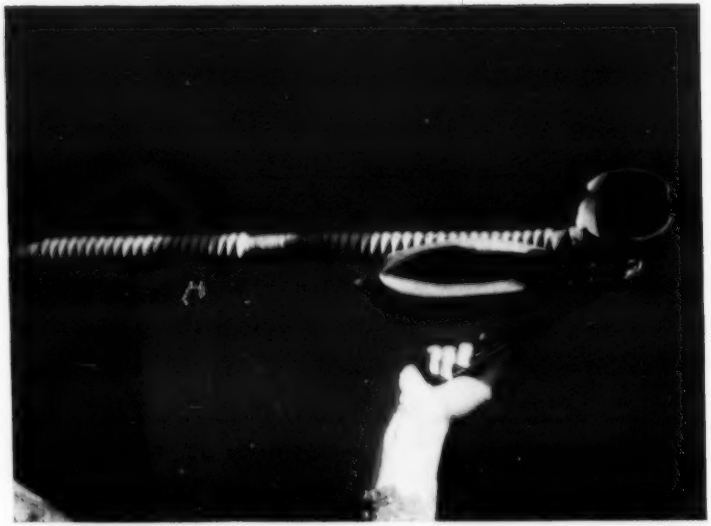
Fig. I.





Graph showing the increase in depth of respiration, (as measured by expansion of the chest wall), after Inhalation from the $C.O_2$ Inhaler.

Graph showing the change in respiratory rate following 4½ minutes inhalation with the $C.O_2$ Inhaler



percentage of carbon dioxide must fall and breathing becomes less deep.

The actual percentage in the healthy adult subject has been tested and varies from one to five per cent. The oxygen content of the apparatus has been found to vary from 12.5 per cent. to 19 per cent., the average being 16 per cent.

If three per cent. carbon dioxide is inhaled the patient has a tidal volume of 1,000 c.c. (expired air contains 16 per cent. oxygen) and each thousand will contain 160 c.c. of oxygen.

Breathing atmospheric air (20 per cent. oxygen), with a tidal volume of 500 c.c. means that 100 c.c. per breath of oxygen are inhaled. This means that over a litre per minute more oxygen is inhaled when the instrument is used. That the apparatus depends upon carbon dioxide for its effects (and not oxygen lack) is shown by the graphs.

This type of therapy is of most value in the treatment of pulmonary complications. In bronchitis the inhalation results in an acid bronchial secretion which probably inhibits the growth of pneumococci. The secretion shows a tendency to be made more moist and is, therefore, easier to get rid of, a fact which is verified clinically. The moisture from the accumulation in the apparatus of expired air is probably responsible in part for this.

Other indications are in hiccough and where expansion of the lungs is desired, e.g. after drainage of empyæma.

The patient is instructed to breathe for five minutes every waking hour, and care is taken that during the inhalation the mask fits the face without allowing air to leak into it. In the case of old patients or those who have dyspnœa on exertion, the tube can be shortened to half the length.

Sterilisation can be effected by total submersion in any reliable antiseptic solution which does not materially affect rubber.

The instrument has been in use for the past year at the David Lewis Northern Hospital and Smithdown Road City Hospital, Liverpool. It is made by Mr. A. Charles King, of London.

My thanks are due to Dr. R. J. Minnitt for his encouragement and advice, to the Honorary Surgical Staffs at the David Lewis Northern Hospital, and to Dr. J. P. Steel, Superintendent of Smithdown Road Hospital, for permission to use the apparatus at this hospital.

A FURTHER CASE OF ETHER CONVULSIONS

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IN view of the present interest in the causes and pathology of "ether convulsions", I thought that the following case, presenting so many points of similarity to the one described by Steel,[1] was worth reporting in some detail.

The patient, Mrs. W.S., aged 39, was admitted to hospital on 3rd of March, 1939, under the care of Mr. John Stallworthy, on account of uterine hæmorrhage. On examination, she was a thin, frail woman, blanched from loss of blood. A blood-count on admission showed red blood-corpuscles, 1,880,000 per cmm.; hæmoglobin, 25 per cent; colour index, 0.7; reticulocytes, 3.6 per cent; and leucocytes, 4,500 per cmm. A blood-transfusion administered by the indirect drip-method was started immediately, and was continued until three pints of blood had been given. This improved her general condition considerably. However, on the evening of the 4th of March she began to bleed again. A hysterectomy was decided upon to conserve the improvement which had already been effected. Immediately before operation her temperature was varying between 99.5° F. and 100.2° F., her pulse was 100 to 110, and her respirations were 20.

At 8.20 p.m. she was given 1/100 grain (0.00065 gm.) atropine hypodermically.

At 9.05 p.m. she was given 1/6 grain (0.011 gm.) morphine intravenously to get a rapid effect.

At 9.40 p.m. the induction of anæsthesia was started. At the moment of starting the patient seemed satisfactorily quiet but not over-morphinised. Pentothal sodium in 0.3 gm. dose was given intravenously, and then the nares and pharynx were sprayed with 20 per cent. solution of cocaine. The administration of nitrous oxide and oxygen by means of a Connell closed circuit

machine with carbon-dioxide absorber was started when the patient began to show signs of returning consciousness, and the ether drip was turned on slowly, the anæsthesia meanwhile being smooth and satisfactory. As soon as the patient had reached a sufficiently deep plane of anæsthesia, a Magill's endotracheal tube was passed via the nose without any difficulty. The mask, which had been removed for this procedure, was then re-applied to the face. Soon afterwards the respirations became very shallow, the patient appearing deeply anæsthetised although she had had only a moderate amount of ether (20 c.c.) At the same time her pupils were small and her conjunctivæ moist. I thought the pre-operative dose of morphine had been rather too heavy for the efficient functioning of her respiratory centre, and that this probably accounted for her condition. However, there appeared no immediate cause for alarm, so the basal oxygen supply was adjusted to 300 c.c. per minute, the ether drip was stopped, and the patient was moved into the theatre at 9.53 p.m.

At 9.55 p.m. the operation was started. The patient was tilted into the Trendelenburg position almost immediately. At 10 p.m. the surgeon had reached the peritoneum. He stated that the abdominal muscles were not sufficiently relaxed. Accordingly, the ether drip was turned on again in an attempt to increase relaxation. The respirations gradually became shallower until, at 10 p.m., thirty-five minutes after the start of the anæsthetic, they were reduced to a series of short inefficient gasps associated with a curious rhythmical movement of the mylohyoid group of muscles. The colour remained good, the blood pressure remained low (70/40 mm. Hg.) as it had been since the start of the operation. The pulse varied between 110 and 120. At this point (10.15 p.m., thirty-five minutes from induction) I should have estimated her level of anæsthesia to be about the middle of the second plane judging by her eye signs—pupils small and conjunctivæ clear and moist—but her respiratory signs were those of one in about the lower third or upper fourth planes. I feel that this double level is the best way to describe my clinical impression of her at that moment. At 10.20 p.m. (forty minutes from the start of induction) the surgeon stated that she was more relaxed, although not completely. I felt, however, that it would be unwise to force her any deeper on account of her feebly acting respiratory centre.

At 10.22 p.m., about two minutes later, when the surgeon was finishing the pelvic peritoneal "toilet", I noticed the onset of fine twitching movements around the patient's eyes. These movements rapidly became more severe, and spread within two or three minutes (10.25 p.m.) over the face, especially around the mouth, and thence via the neck to the trunk and limbs. The movements were jerky and irregular, and were violent enough to require restraint of her lower limbs. The muscles of the neck, especially the sternocleidomastoids, were strongly involved.

The patient was at once raised from the Trendelenburg to a horizontal position (10.25 p.m.) The ether drip had been turned off some minutes before the onset of the convulsions. The re-breathing bag was now emptied of its ether and oxygen, and was refilled with oxygen alone. The lungs were rhythmically inflated about fifteen times a minute with pure oxygen by means of manual pressure on the bag. After a few inflations the bag was emptied to free it of the exhaled ether (the exhaled carbon-dioxide being absorbed by the soda lime canister) and was at once refilled with oxygen. The process was repeated many times. The solution of pentothal sodium which was left in the ampoule from the induction was drawn into a syringe. However, at 10.30 p.m., after about five minutes of the artificial respiration described above, the spasms began to get weaker, especially in the abdominal area, although the neck and face were still fairly strongly involved.

At 10.32 p.m. approximately 5 c.c. of blood were quickly taken from a vein in the left arm for determination of serum calcium. Artificial respiration was temporarily stopped meanwhile. At 10.35 p.m. rhythmic compression of the bag and frequent emptying was resumed. The spasms had now disappeared from the trunk and limbs, but there was still some twitching around the mouth and eyes, and an occasional contraction of the sternocleidomastoid muscles. These movements became progressively less, and at 10.37 p.m. the convulsions had gone, having lasted in all about fifteen minutes.

During the convulsions the blood pressure rose steadily from 70/40 at 10.22 p.m. to 125/60 at 10.45 p.m. The pulse also rose from 110 to 125 during this time. At 11 p.m. the blood pressure had fallen to 120/50 and the pulse to 120. In the meantime the surgeon, after a short interruption at the beginning of the convulsions, had managed to close the incision. The last suture was

inserted as the convulsions finally died away. At 11.25 p.m. I noticed that the patient's skin felt very hot. I therefore took her axillary temperature and found it to be 101°F.

The subsequent recovery to consciousness was slow, and respiration remained shallow for about another hour. During the first part of this period the patient exhibited a greyish dusky colour whenever the administration of oxygen was stopped for more than a minute. Gradually her respirations became deeper and more nearly normal, and she maintained her normal colour for increasingly long periods, till, at about 11.45 p.m., it was considered safe to discontinue the administration of oxygen entirely. She was sent back to the ward with the endotracheal tube in position. At 1 a.m. she began to show muscular activity. At 1.20 a.m. she began to cough and to resent the presence of the endotracheal tube, which was then removed. From this point her recovery to consciousness was normal. The total amount of ether that had been employed in the closed circuit during the anaesthesia was 60 c.c. (2 ounces).

She was discharged from the hospital to a convalescent home on March 17, 1939. Her hæmoglobin had risen to 60 per cent., with red blood corpuscles at 3,300,000 per cmm. and a colour index of 0.9. The surgical condition causing the hæmorrhage was proven to have been adenomyoma of the uterus. The sample of blood for determination of serum calcium which was taken during the convulsions unfortunately had to remain in a refrigerator over the week-end, by which time it had become partly hæmolysed. The laboratory reported the value for the serum calcium as 8.8 mgms. per 100 c.c. but added a note that the blood was hæmolysed. As the normal value for serum calcium is considered to be 9 to 11 mgms. per 100 c.c., and the normal value of whole blood calcium is about 5 to 7 mgms. per 100 c.c. the slightly low figure of 8.8 mgms. can be explained by the hæmolysis present, and can therefore, I think, be taken as normal.

Comment.

Comparing this case with that of Steel[1] there are many points of similarity. Both patients were women of about 40 (39 and 42 respectively) who were having a hysterectomy performed because of hæmorrhage. In each case the Trendelen-

burg position was employed. In both cases a closed circuit system for absorption of carbon dioxide was used. In both cases the convulsions began approximately half an hour after induction of and during maintenance of profound surgical anæsthesia. In my own case the patient was grossly anæmic compared with slight anæmia in Dr. Steel's case. In addition my patient's temperature was 99.5° to 100°F., due perhaps to a reaction after her blood transfusion.

Turning to the other cases of "ether convulsions" reported in the literature, we find most of them occurring in children or young adults. There is usually some infection present giving rise to fever. The typical convulsions arise during fairly deep anæsthesia. A large number have occurred in operations involving the Trendelenburg position. It has been observed frequently that the operating theatre has been unduly hot at the time. It has been said that the condition does not occur when the closed system for absorption of carbon dioxide is used, but several recently reported cases, including the one under review, have disproved this statement.

Reviewing these facts in the light of my clinical impression of the case, I suggest that there is strong evidence of accumulation of carbon dioxide, in spite of the fact that the carbon dioxide absorption method was being employed. This latter fact does not preclude the possibility of an increased tension of carbon dioxide in the alveoli. It does insure that the inspired gases are approximately freed from carbon dioxide. If, however, respiratory excursions are extremely shallow during profound anæsthesia, the gaseous exchange is correspondingly reduced with a resulting accumulation of carbon dioxide in the alveoli.

The patient in question was frail and grossly anæmic, suggesting the possession of a respiratory centre with a comparatively poor supply of oxygen and, therefore, little margin of reserve. She was feverish, which necessarily means that she had an increased rate of metabolism and a corresponding increase in production of carbon dioxide by the tissues. Many of the reported cases of "ether convulsions" have occurred in children and young adults. The higher basal metabolic rate occurring during youth may be a factor in this incidence.

Morphine grains 1/6 (0.011 g.m.) intravenously, although not a large dose for an average woman, was probably a rather heavy dose for her respiratory centre to withstand, impoverished

as it was by anæmia. This suggestion is supported by the fact that she exhibited very shallow breathing after the onset of anæsthesia, thus giving rise to my impression that her respiratory system was in a deeper plane than the rest of her body. Her lack of relaxation, although her respirations were shallow and jerky, fits in with these suggestions. The combination of these factors of increased production of carbon dioxide, inefficient ventilation of the lungs, rendered still less efficient by the difficulty of adequate pulmonary expansion in the Trendelenburg position, and profound anæsthesia produced with ether, would produce a fairly rapidly increasing tension of alveolar carbon dioxide, giving rise in its turn to a damming back of carbon dioxide in the blood and tissues.

It has been shown that excessive concentrations of carbon dioxide in the blood of animals do produce convulsions[2], and the same effect has been demonstrated in man by Nosworthy's personal experiments[3] and by Waters[4]. It seems likely, therefore, that increased tension of carbon dioxide may have been a factor in the production of the convulsions in the present case, perhaps aided by cerebral congestion associated with the Trendelenburg position.

It is unfortunate that the specimen for determination of serum calcium had to wait over the week-end before estimation, during which time some hæmolysis had taken place. This tended to lower the value, but the slight deviation from normal would make it unlikely that the convulsions could have been due to tetany. Although tetanic convulsions are due to a lowering of the ionised portion of the calcium present as distinct from the total serum calcium, it is extremely unlikely that it is possible to get sufficient lowering of the ionised calcium to cause symptoms of tetany without a corresponding lowering of the combined calcium present. The theory that an increased concentration of carbon dioxide played a part in the production of these convulsions is supported by the apparent response to the treatment employed, but in evaluating the effectiveness of this treatment it must be remembered that a certain proportion of reported cases have recovered spontaneously.

The patient was raised from the Trendelenburg to the level position (a) to make respiration easier, and (b) to decrease the cerebral congestion. The subsequent rhythmic inflation of the patient's lungs with frequently renewed oxygen served (a) to

get rid of excess carbon dioxide from the lungs and blood, and so from the tissues, and (b) to wash out the excess of ether from the system and so make the respiratory centre more sensitive with the object of stimulating deeper breathing. Possibly air would have been a better gas than oxygen with which to inflate the lungs in view of the fact that the solubility of carbon dioxide is diminished in blood saturated with oxygen.

The endotracheal tube was an important aid to the artificial respiration because it made free passage of gases possible. Inflation would have been difficult or even impossible without this tube in place if spasm of the cords had accompanied the convulsions. This complication has occurred in most of the reported cases which have not been intubated.

The anti-convulsive properties of the rapidly acting barbiturates for intravenous use, i.e. evipan sodium or pentothal sodium, should be kept in mind. Their use for patients exhibiting violent spasms may be indicated as a purely symptomatic treatment to suspend the convulsions, but their extremely depressant action on an already depressed respiratory centre is not without danger.

Summary.

A case of " ether convulsions " is described.

It is suggested that an increased tension of carbon dioxide in the tissues may have been a factor in the production of this condition. Blood taken for the determination of serum calcium during these convulsions showed what is equivalent to a normal value.

The suggested treatment is to put the patient at once into the horizontal dorsal position, thus offering the least resistance to respiration. Artificial respiration through an endotracheal tube by means of regular inflations with oxygen or air performed ten to fifteen times per minute is essential in order to wash out through the lungs any excess ether and carbon dioxide from the tissues. It may be advisable to make use of the anti-convulsive properties of intravenous evipan sodium or pentothal sodium for those patients exhibiting severe spasms. The action of these drugs on the respiratory centre is not without danger, however.

I am indebted to John Stallworthy, Esq., F.R.C.S., for permission to publish this case.

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A LITTLE ABOUT PAUL BERT.

IT is not an inappropriate time at which to recall some of the work of a great French physiologist. Few British anæsthetists are aware of the extent to which the principles on which they conduct the practice of inhalation anæsthesia are based on the investigations and publications of Paul Bert. Bert's work on the effects of barometric pressure variations and of oxygen inhalation under pressure have had much influence on the science underlying the practice of anæsthetics. Born at Auxerre in 1830, Bert was intended for a legal career. His interest in natural science was aroused, however, during a journey in Algeria as a young man. There he watched rats, whose tails some Zouaves had cut off for fun afterwards planting the tail in a wound of the back. The retention of sensibility in the transplanted tails led Bert away from his legal studies to a study of the relationship of nerves, and he wrote his doctorate thesis on "*La greffe animale*". Bert became Claude Bernard's favourite pupil and assistant, and when Bernard vacated his chair at the Sorbonne, and went to the Museum of Natural History, Bert lectured in his place on the comparative physiology of respiration.

Bert's lectures showed the action of the diaphragm and its effect in widening the thorax as well as increasing it anteroposteriorly, and he demonstrated the elasticity of the lungs. Further he demonstrated the innervation of the diaphragm, its effect on intra-abdominal pressure and the origins of the phrenics. His experiments with chloroform illustrated the occurrence of sudden syncope from big doses. Bert also investigated the action on respiration of curare and of strychnine, showing that the former caused spasm in expiration, the latter in inspiration. His chief work in physiology was summed up in his publication "*La pressure barometrique.*" Herein he recorded a number of experiments demonstrating the effects of abnormally high pressure, as in divers, and too low as experienced at high altitudes. The latter could in Bert's time be observed only in balloonists, and Bert organised flights into high atmospheres by observers whom he infected with his own enthusiasm. From

one such flight at a height of 7,500 metres, only one out of three balloonists escaped with his life.

Bert carried out many experiments on the effects of oxygen on respiration, and he demonstrated a fact which the modern anæsthetist does well to bear in mind, that at high pressures oxygen has toxic effects. Convulsions begin, Bert showed, when oxygen reaches a tension of 15 atmospheres, and Bert proved that anæsthetics arrest or prevent these convulsions due to oxygen. Although the effects of high barometric pressure on divers, as illustrated by caisson disease, and of low pressures on mountain climbers were common knowledge before Bert's work, it was this which for the first time gave the symptoms scientific study and by the use of apparatus allowed the symptoms to be reproduced in animals and investigated uninfluenced by any accessory qualities of climate, food, etc. Bert showed that during oxygen convulsions neither the sensibility nor the intelligence were affected. The animals became ataxic, and birds could walk but not fly. One notable phenomenon was that the internal temperature was not increased, showing that the oxygen excess had not caused a heightened metabolism. Post-mortem Bert found hæmorrhages into the diploe of the skull. These he could not account for but said that they were found also after asphyxia.

Bert determined that oxygen does not kill by its action on heart, motor nerves or muscles. Convulsions ensue with comparatively small excess amounts of oxygen in the blood, but only if the tissues are already saturated and in equilibrium with the blood. Oxygen is a poison when it is in the blood to the extent of 55 c.c. per 100 c.c. of blood. Its action as a poison shows like the action of strychnine. The convulsions can be prevented by chloroform. They are due to exaggeration of the motor excitability of the spinal cord. They are accompanied by a fall of body temperature. The poisoning of oxygen causes diminution of oxidation. Bert showed that the absorption of oxygen and production of carbon dioxide are diminished when the tension of oxygen is increased. Nine or ten atmospheres of air are enough to produce the fatal pressure. The blood sugar increases too, that is to say the sugar supplied from the liver is less rapidly destroyed in the organism under pressure. Too feeble a tension of oxygen in the inspired air produces the same physiological effects as too great an one.

Paul Bert's scientific work was hampered and finally put an

end to by his intense political convictions and activities. He was fiercely radical and anti-clerical, and an enthusiastic supporter of Gambetta. He devoted himself also to the cause of higher education and was instrumental in founding two new universities at Lyon and Lille. When he had been elected to the chair of physiology at the Sorbonne he was soon after chosen as Deputy for his native town. According to French law the two posts could not be held at the same time by one man. Bert gave up his post at the Sorbonne and plunged wholeheartedly into politics. Gambetta made him Minister of Education and he took violently anti-Catholic measures. Elementary education was taken out of the hands of the clergy and religious teaching barred in the communal schools. In 1886 Bert was sent to Tonkin as Consul-General. Soon after he died there of dysentery, and it may well be said that a great scientific career was sacrificed on the altar of politics, for Bert was only fifty-six when his life was thus cut short by an illness incurred directly as a result of his political appointment.

A CASE OF RESPIRATORY PARALYSIS UNDER ANÆSTHESIA, DUE TO CEREBELLAR ABSCESS

BY

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IN these days of mechanical respirators it is a mere commonplace for artificial respiration to be carried out for long and indefinite periods. The following case of prolonged *manual* artificial respiration which occurred more than five years ago, in the " pre-iron lung " era, is, therefore, I submit, of some—if merely historic—interest.

A girl of eleven years of age was admitted to the Ear, Nose and Throat Department of the Middlesex Hospital on the 22nd December, 1933. There was a history of left ear-ache and discharge of one month's duration, and, more recently, of increasing weakness, vomiting and vertigo.

Examination. The child was rather drowsy but lay in bed without complaining. The head was turned to the right but could be turned to the left without discomfort. There was no neck rigidity. There was a coarse nystagmus on looking to the left only. The left pupil was larger than the right but there was no papillœdema. The whole of the left side was more flaccid than the right. The left fingers were hyper-extended when the arms were held out. The left hand fell away when both were extended. There was ataxia with the left hand in the finger-nose test but the past-pointing was negative. The biceps and supinator reflexes in the left arm were diminished and the triceps jerk was not obtainable. Knee and ankle jerks, equal. Plantar

responses were both flexor. There was marked dysdiadokokinesia of the left arm. Temperature 97.2; pulse 92.

Operation. The next morning, under a gas-ether induction maintained by ether and oxygen through a Shipway's apparatus a left Schwartze mastoidectomy was performed. Some granulations were found in the antrum and in some cells, but there was no definite pus. The lateral sinus and dura of the middle fossa were exposed and found to be normal. The dura of the posterior fossa in front of the sinus was similarly found to be normal. There were no mastoid cells behind the sinus, and the dura was not exposed. Dura in Trautmann's triangle incised but nil abnormal found. The cerebellum was not explored. The wound was left open and packed with gauze.

Subsequent Progress. On the 24th and 25th December the temperature remained at 97.5 and the condition in *statu quo*. The wound was dressed and the gauze plug changed under gas. On the 26th the patient was not so well. She was drowsy and the pulse was down to 80 in the evening. On the 27th the patient seemed a little better but she had a headache and the pulse was now 76.

The patient was, as on other days, given gas in her bed at about 6 p.m. for the gauze packing to be removed. As this manœuvre was almost completed her respiration failed quite suddenly in full inspiration. There was no cyanosis. The face was very pale. The pulse was very rapid and thin. As there had been no obstruction to breathing it was at once recognised that these signs pointed to a central respiratory paralysis. Artificial respiration was begun whilst a mixture of 95 parts oxygen (O_2) and five parts carbon dioxide (CO_2) was administered through a face-piece. Respiration was resumed in a few minutes at about three to the minute. After about seven minutes respiration failed again. In the belief that the condition was due to a medullary 'cone" this interval had been utilised by sending for a lumbar puncture tray. A lumbar puncture was performed and 38 c.c. of saline injected into the spinal canal. Respiration was reinstituted but very slowly and only for about ten minutes. A further intra-thecal injection of 20 c.c. had no effect. All this time artificial respiration was continued with the addition of the O_2CO_2 mixture. The pulse was now very rapid and thin; a vein in the left arm was opened to relieve the congestion and the strain on the right heart, but very little bleeding occurred and no

benefit was observed. With a pair of bone forceps bone was removed from behind the sinus. An emissary vein was injured during this procedure which led to some difficulty. A needle was inserted with the idea of relieving the intra-thecal tension. Pus escaped through the needle, about 10 c.c. in all. In the meantime the theatre staff had been warned as to what was occurring and instruments were being boiled.

At this stage, therefore, it was seen that further exploration was necessary, so the patient was moved in her bed to the theatre, artificial respiration and the administration of O_2CO_2 being maintained in the lift and along the corridors. In the theatre more bone was removed posterior to the sinus and the latter was divided between ligatures. Much difficulty was experienced in controlling the lower end, and the patient lost a considerable amount of blood. The abscess was opened and about 1½ ounces of pus escaped. Respiration commenced most dramatically within fifteen seconds of incising the abscess and soon became regular though still slightly slow. At the moment of incision the dilated pupils contracted and the globes moved. Tone in the limbs, which had been flaccid since respiration first failed, also returned within a matter of seconds.

The hæmorrhage was stopped, a small tube was inserted into the abscess cavity and 100 c.c. saline was given intravenously. Patient was returned to bed, the feet were raised and heat was applied. Patient was now breathing normally and, though not conscious, resented having her throat swabbed out. Artificial respiration had been carried out for forty-five minutes during the greater part of which time respiration was entirely suspended.

At 8 p.m. the patient seemed a little better and moved her eyes when addressed by name.

At 10 p.m. the condition was the same, the pulse being 160 and respirations 180.

At 12 p.m. patient died.

Post Mortem. There was a left cerebellar abscess with a fairly thick wall. The path of infection was not demonstrable. There was œdema of the lungs and early broncho-pneumonia.

My grateful thanks are due to Mr. C. P. Wilson and Mr. J. P. Monkhouse for their permission to publish this case.

Summary. Central respiratory paralysis occurred during nitrous oxide anæsthesia being given for the purpose of chang-

ing the gauze packing of the fourth day after a Schwartze mastoidectomy. Despite the intrathecal injection of saline to combat a possible medullary "cone," normal respiration was not resumed until the cerebellum was exposed and incised, 1½ ounces of pus escaping. Artificial respiration and the administration of an O_2CO_2 mixture was continued throughout the forty-five minutes which elapsed.

Patient died eight hours later.

Post-mortem. Left cerebellar abscess, pulmonary œdema, early broncho-pneumonia.

THE ASSOCIATION OF ANÆSTHETISTS, GREAT BRITAIN AND IRELAND

THE Annual General Meeting of the Association is usually held in October. This year none has been held at all because the Council, at an emergency meeting held in November, decided that so many members of the Association would be unable to attend, owing to their absence on war service or that of the Ministry of Health, that it would be unwise to call a general meeting. The Council resolved to continue the present officers in their posts until the next general meeting could be held, and nominated reserves in case the present personnel were depleted by casualties. The secretary being away on war service, a member of the Council was deputed to act for him for the time being.

The Council had been in correspondence with the British Medical Association as to the advisability of the Association being represented on the Emergency Committee of the B.M.A. Their view has prevailed and the Association's President, Dr. G. Mennell, has now been appointed to the Emergency Committee. The Council were anxious that similar representation should be secured with the Ministry of Health. Almost every important specialty has a consultant adviser whom the Ministry recognises as representing his speciality and consults with regard to matters affecting that speciality. The anæsthetists have no such representative, and the need of one has been brought forcibly to the notice of the Council by letters that they have received from members of the Association who complained of certain obvious injustices involved in the terms under which they were serving the Ministry. We are sorry to say that the representation asked for has not been conceded by the Ministry.

The Council passed a resolution which will doubtless please the members of the Association. It resolved to absolve members during the current year from their obligation to pay the

yearly subscription, and it suggested that this resolution was likely to be repeated if the duration of the war rendered it necessary. It is a tribute to the excellent financial position of the Association that its Council can afford to act in so considerate a manner towards the members.

ABSTRACTS

"Pulmonary Embolism." B. Pllwes, in *Canadian Medical Association Journal*, September 1939, p. 271.

The author points out that pulmonary embolism occurs more frequently than it did a decade ago, not that it is simply more often found, because now more thoroughly and systematically sought for post-mortem. He divides the cases which were the foundation of his article into post-operative and non-operative, the post-operative being those patients who had undergone operation, pregnancy, or fracture within one month of the first attack. The cases were classified as:

(1) Incidental—the embolism was small or the patient recovered.
(2) Contributory—embolus larger but not by itself fatal.
(3) Fatal—embolism the immediate cause of death.

A large series shows that pulmonary embolism is more frequent on the medical than on the surgical side of an hospital. Pulmonary embolism rarely attacks children, but from the forties its possibility increases. "That there is some change in the blood itself that permits platelet deposition and the building up of a thrombus seems an inescapable conclusion."

The other mechanism necessary is slowing of the venous flow. That this is the conclusion to be drawn from study of his cases the author demonstrates under these headings:

(1) High incidence of heart disease.
(2) Greater incidence of fatal embolism after operation.
(3) Frequent embolism after spinal anæsthetic.
(4) Importance of time in bed.
(5) Advent of the modern Gatch-frame bed.

Embolism was most frequent during the second week in bed, both in non-operative and post-operative groups. There are several examples of patients who, having had two weeks in bed before operation, suffered embolism in the operating room or after operation. The most important factor in the increase of

pulmonary embolism is the comfortable immobilisation of the patient in the modern bed. Pulmonary embolism was less frequent a decade ago because the patient was not comfortable enough on a horizontal mattress to remain immobile for any length of time. To-day, with knees half-flexed and the soft mattress supporting the trunk, the patient does not toss and turn, move the legs, aerate first one side of the chest and then the other. It is this restlessness which is needed for the proper flow of blood in the lower extremities and pelvis.

"*Capillary Permeability in Narcosis.*" R. D. CRESSMAN and R. RIGDON, in *Archives of Surgery*, October 1939 p. 586.

THE authors have studied the question of capillary permeability and inflammatory reaction experimentally. The animals used were rabbits and mice, and the anæsthetics were ether, alcohol, and pentobarbital. Dale and Laidlaw have previously shown that rabbits under anæsthesia fail to show the vasodilator response to small intravenous injections of histamine. The present work demonstrates that capillary permeability in areas of inflammation is altered in rabbits narcotised with alcohol or ether; the inflammatory response may be greatly or only slightly diminished. This work is of interest to anæsthetists because of its bearing on shock, in which condition it is believed that capillary permeability is increased.

"*Pentothalic Acid in Midwifery.*" G. C. STEEL, in *Lancet*, July 29, 1939, p. 251.

VERY satisfactory results are recorded following the use of pentothalic acid by the mouth to alleviate the pains of labour. Pentothalic acid is a slightly more stable compound than the usual pentothal. It was given to a series of 200 women in labour. The first dose of 6-8 gr. was given when pains came on at about five minutes interval. This was repeated after three quarters of an hour. From then nearly to delivery 2-4 gr. were given every half to one hour, depending on the patient's response; usually a dose every three quarters of an hour gave a good result. The patient usually became drowsy and slept between the pains; these woke her but caused not much distress. During her second stage gas and air was given. By the time delivery took place the woman had generally had 25–35 gr. pentothalic acid; she was

drowsy and placid, and co-operated willingly during pains and between them. There was no case of excitement and no harm could be attributed either to mother or infant from the action of the pentothalic acid.

"*Experience with Cyclopropane.*" GILBERT TROUP, in *Med. Journ. Australia*, July 29, 1939, p. 104.

THE author summarises his use of cyclopropane and other anæsthetics in a series of 2,332 operations; cyclopropane was used in 33.3 per cent of the total. Tables give the statistical results as regards vomiting, restlessness, distension, etc., and we note that vomiting was absent in only 28.5 per cent. of those who had cyclopropane; it was slight in 48.4 and severe in 6.6. He reports one death which he attributes to over-dosage with cyclopropane. The operations performed under cyclopropane included thoracoplasty, abdomino-perineal excisions of rectum, lobectomy, gastrectomy and other abdominal operations as well as 58 dental operations. Troup comes to the conclusion that cyclopropane is especially valuable in chest surgery and in long intracranial operations, and he believes that there is much virtue in a mixture of cyclopropane and nitrous oxide gas. He alludes to the "pseudo shock" which may follow sudden withdrawal of a rich oxygen mixture, and suggests a way to prevent it by dilution of the mixture with air in the later stages of the administration.

"*Morphine Scopolamine and Atropine.*" R. N. WATERS, in *Texas State Journ. Med.* 34: 4,304, August 1938.

FROM his experimental observations on normal men exposed to the influence of the drugs and from clinical experience with them Waters draws some important conclusions as to the use of morphine scopolamine and atropine for purposes of premedication. Briefly it may be said that morphine and scopolamine together make by far the most satisfactory preliminary to an anæsthetic. Their good sedative effect and their small influence on circulation and respiration place them above either of them used alone and above atropine. Morphine alone caused nausea and vomiting; when used with scopolamine this result was rare. The ratio of morphine to scopolamine which should be used is 25 to 1, and the optimum time of administration for premedication

before an inhalation anæsthetic is at least one and a half hours. This is considerably longer than is customary, and it is likely that the best results are often not obtained because premedication is given too close to the anæsthetic.

"*Vinesthene in Dental Surgery.*" PINSON, BRADBURY, and E. B. JONES, in *B.M.J.*, October 7, p. 729.

THE authors describe an apparatus for administration of vinesthene in conjunction with gas and oxygen given nasally. The vinesthene is injected into the re-breathing bag of a modified Clarke's apparatus from a 10 c.m. record syringe. A diagram of the apparatus is supplied. After sixty seconds' application an anæsthesia of fifty seconds is obtained. The process is highly recommended for children.

In the same number of the *British Medical Journal* (p. 725) is recorded a case in which cardiac rhythm was restored after as long as twenty-nine minutes after circulation had stopped. When circulation was restored the patient presented the typical picture of decerebrate rigidity. He died eighteen hours after operation.

REVIEW.

"*Untoward Effects of Nitrous Oxide Anæsthesia.*" C. B. COURVILLE, M.D., Professor Neurology and Psychiatry, College of Medical Evangelists, with Foreword by Dr. Yandell Henderson, Professor Applied Physiology, Yale University. Pacific Press Publishing Association, California. 1939. pp. 674. Price 4.75 dollars.

THIS book makes out a case against nitrous oxide anæsthesia which has never before been clearly stated. Briefly it may be summarised as declaring that, by reason of the oxygen lack which inevitably accompanies deep anæsthesia from nitrous oxide as well as of the narcotic action of the gas itself, patients may suffer afterwards from damage to the brain. The damage may show itself by a variety of symptoms, and the period before which they show may be short or long after apparent recovery from the inhalation. In the worst cases there is no recovery of consciousness, and the patient dies in coma, sometimes after convulsions or various muscular rigidities. In other patients consciousness is completely restored but symptoms develop indicative of damage to the lenticular nucleus or to the corpus striatum. There may be defects of vision, muscular disabilities, and serious mental disturbance.

The author substantiates his hypothesis by relating the details of twenty-six cases and giving full and illustrated accounts of the cerebral conditions found post-mortem. Six of these cases may be ruled out as there were present in the patients intercurrent illness severe enough to prevent one from justly attributing the fatality to nitrous oxide. The other twenty appear to be true examples of the cause and effect which, the author maintains, exist when nitrous oxide anæsthesia is followed by cerebral symptoms. Post mortems show that the type of damage is not that which is found in brains damaged by narcotics but is identical with that found after artificial deprivation of the brain of

blood and after carbon monoxide poisoning. That is to say the brain damage is due to oxygen deprivation, to anoxia. This book is full of interest and of valuable warning to the practical anæsthetist, for it inculcates the lesson that even short periods of oxygen shortage must not be allowed, and may be followed by damage the true origin of which has often been unsuspected.

OBITUARY.

A. L. Flemming, M.B., Ch.B.

WE greatly regret to record the death of Dr. A. L. Flemming, which happened on August 25th at his Bristol home. Flemming had been for years on the Editorial Board of this Journal, where his sound judgment, sterling honesty and straightforward character were as much valued as his quiet, genial and humorous manner. In the West of England Flemming was rightly regarded as a pioneer in anæsthetics as a speciality, and many generations of students owed their interest in and knowledge of anæsthetics to his practical and theoretical teaching in the University of Bristol and its associated hospitals. To London anæsthetists he was well known because of the enthusiasm which caused him to be a frequent attendant at the Royal Society of Medicine, and he was duly elected President of the Section of Anæsthetics in 1922. Flemming was a frequent contributor to the literature of his subject, in our own pages as well as elsewhere. During the last war he served both in France and at the Royal Naval Hospital, Rosyth. Perhaps his most valuable contribution to the advancement of anæsthesia was in the early days of " open ether," which method he exploited to its fullest possibility. Outside the practice of his speciality Flemming was a man of varied interests and a companion it will be hard to beat. He was at one time President of the Bristol Dramatic Society, he was a keen fisherman, and he was an ardent ornithologist. Few men who have achieved as much success as Flemming have owned so few enemies or so many friends. He had a sterling worth and simplicity which were obvious on the first acquaintance, and exercised a charm which few could resist. To those intimate relatives whom he leaves behind we offer condolences which are the more sincere because of the personal loss of which we ourselves are painfully conscious.

J.B.

F. H. McMechan, M.D.

ANÆSTHETISTS the world over have suffered a great loss by the death of McMechan. Broadly speaking, although at the time of his death it was more than twenty-five years since he had been actively engaged in anæsthetic practice, no man has during the last quarter of a century done more valuable work in promoting the cause of anæsthesia. McMechan may be truly said to have made the Western universe "anæsthesia conscious." Nothing but intense enthusiasm, concentrated energy and a profound conviction of the importance of the objects for which he strove could have enabled a man to establish the associations and societies, and the Journal for which McMechan was responsible, let alone to carry out world-wide journeys which he made, and to establish and consolidate friendships with anæsthetists in almost every quarter of the globe. Many of our British readers will cherish the memory of their occasional meetings with McMechan, for it needed no long association with him to convince one that here was, in truth, an exceptional man. When one considers all that he achieved in spite of his terrible physical limitations one is left wondering what he might not have done if ordinary health had been granted to him. Yet it is quite likely that if that had been so his interest in and great talents for organisation might not have had full play in a life which would have been probably largely occupied by the successful and pioneering practice of anæsthetics. Indeed we may console ourselves with the thought that McMechan's illness, which put him out of practice, also brought into being an organisation of anæsthetists which might otherwise have been long delayed. The "Current Researches" which he founded in 1922 have become a common ground for English-speaking anæsthetists all over the world. McMechan held, in addition to his many other offices, the post of Associate Editor to the *British Journal of Anæsthesia*. In all his work McMechan was sustained by the sympathetic and highly efficient co-operation of his wife; to her we would offer our most sincere condolence.

J. B.